

# Expedition Two Science

With the addition of the US Laboratory Destiny this month, scientists are poised to begin a new era of space-based research aboard the International Space Station. Flight 5A.1 will deliver the first facility-class payload, the Human Research Facility, and a suite of radiation experiments. Flight 6A will deliver the first two EXpedite the PROcessing of Experiments to Space Station (EXPRESS) racks and a host of subrack experiments.

The experiments conducted during Expedition Two will characterize the ISS micro-gravity and radiation environments, test active rack isolation equipment, grow large protein crystals for pharmaceutical and materials processing applications, and photograph geological and meteorological events on Earth.

**Increment Two also adds the Payload Operations Integration Center at Marshall Space Flight Center with five cadre teams to support round-the-clock operations. By Flight 6A, three Telescience Support Centers (at JSC, MSFC and Glenn Research Center) and remote sites around the country will be online.**

These include Boeing-Houston, Boeing-Seattle, Harvard University, the University of Alabama Birmingham, the University of California - San Diego, the University of Colorado - Boulder and the University of Wisconsin.

## Increment Two NASA payloads

## Human Research Facility

- Human Research Facility**
- Dosimetric Mapping
  - Bonner Ball Neutron Detector
  - Hoffman-Reflex
  - Phantom Torso
  - Interactions
- EXPRESS Rack 1**
- Advanced Astroculture
  - Microgravity Acceleration Measurement System
  - Space Acceleration Measurement System
  - Commercial Generic Biotechnology Apparatus
  - Protein Crystal Growth-Single Thermal Enclosure System
  - Commercial Protein Crystal Growth
- EXPRESS Rack 2**
- ARIS-ISS Characterization Experiment (ARIS-ICE)
  - Physics of Colloids in Space

## Stowed or Deployed Payloads

- Crew Earth Observations
- Earth Knowledge Acquired by Middle Schools (EarthKAM)
- Protein Crystal Growth—Biotechnology Ambient Generic

# Station truss segments arrive at Ellington Field



NASA JSC 2001e03693 Photo by Bill Stafford

**STATION TRUSS TEST SEGMENTS ARRIVE AT ELLINGTON FIELD**—The integrated Port 3 and Port 4 (P3/P4) space station truss Static Test Article is unloaded from the Super Guppy at Ellington Field. The P3/P4 STA will be transported to Bldg. 924 at the Sonny Carter Training Facility for outfitting, and then delivered to the JSC Vibration and Acoustic Test Facility in Bldg. 49, where it will undergo acoustic verification testing. Upon completion of the acoustic test program, the P4 protoflight portion of the STA will be refurbished to form the S6 flight element.

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## Expedition crew rotation

performed in Orlans (Russian spacesuits). (A glitch that recently occurred with the Orlans is expected to be resolved.)

Expedition Two crewmembers will activate the Russian Docking Compartment during two scheduled EVAs. These space walks, to be conducted during the stage between 7A and 7A.1, will be performed in Orlans using the compartment as the airlock. The first of these EVAs will be performed by Usachev and Voss, the second by Usachev and Helms.

The Expedition Two crew is the first to complete training on tasks associated with conducting an EVA out of the Joint Airlock in a U.S. Extravehicular Mobility Unit. The crew used the Joint Airlock Facility in the Space Station Mockup Training Facility in Bldg. 9 to practice all EMU preparation and deferral activities including EMU checkout, EMU donning, Airlock depress and repress, EMU doffing and EMU water recharge. While the 7A shuttle crew will be the first crew to perform an EVA from the Joint Airlock, the Increment Two crew would also use it in the event of an unscheduled EVA during the 7A to 7A.1 stage.

The Expedition Two crew received training in Simplified Aid for Extravehicular Rescue, or SAFER, procedures in the Virtual Reality Lab and in EMU caution and warning use in a

simulator in Bldg. 4. As a final “dress rehearsal” for their EMU tasks, crewmembers participated in a vacuum chamber run in which they suited up in flight EMUs and interfaced with qualified airlock hardware.

Each Expedition crew is trained to respond to a number of unscheduled tasks that can occur on orbit. Unscheduled EVA task training includes virtual reality sessions, Neutral Buoyancy Lab runs, and air-bearing floor mass-handling sessions. These consist of deferrable tasks for shuttle missions and maintenance tasks in the event of an onboard failure of an orbital replacement unit.

The Expedition Two crew officially

began training on Sept. 15, 1997. In addition to their EVA training, crewmembers spent about three weeks training in Canada to operate the SSRMS. The crew trained in many facilities at JSC including the Space Station Training Facility as well as the Multiuse Remote Manipulator Development Facility in Bldg. 9.

The Expedition Two crewmembers will live aboard the ISS until mid-year. Their return trip, STS-105 (ISS Assembly Flight 7A.1), is currently scheduled for July.

At Roundup press time, *Discovery* was scheduled for launch on March 8. Mission duration is 11 days. ■



At the Shuttle Landing Facility, workers begin offloading Raffaello, the second Multi-Purpose Logistics Module for the International Space Station, from the "Beluga" Super Transporter that brought it from Italy. Weighing nearly 4.5 tons, the module measures 21 feet long and 15 feet in diameter.

## Approaching the station

On the day of rendezvous, the shuttle will approach from behind and below the ISS. When the relative range to the ISS is approximately 2,000 feet, STS-102 Commander Jim Wetherbee will assume manual trajectory control until docking. At this time, the shuttle will transition to approach along the ISS +Rbar (the Rbar is the radius vector, with the origin at the ISS and positive toward the center of the Earth) until it reaches a range of 500 feet. At 500 feet on the +Rbar, the shuttle will initiate a 90-degree flyaround from the ISS +Rbar (below the ISS) to the +VBAR (in front of the ISS). This flyaround, known as the TORVA (Twice Orbit Rate to VBAR Approach), takes approximately 12 minutes to perform and the shuttle approaches from 500 feet to 300 feet during this phase.

The shuttle will continue its approach along the +VBAR and must stay within an 8-degree corridor once inside 250 feet. The approach corridor and relative range is measured from the ISS docking port to the shuttle docking port.

Previous ISS docking missions required docking to occur while passing over a Russian ground station so that commands could be uplinked to the ISS immediately after docking. Since a crew will be inhabiting the ISS, this ground command capability is no longer required, thereby eliminating the need to stop at 170 feet to set up conditions for a Russian ground station pass. The shuttle will stop for about five minutes at 30 feet to view the ISS docking target through the centerline camera and make any necessary attitude alignment adjustments before docking. The shuttle will then proceed along the +VBAR within a 5-degree corridor to dock to the PMA-2 docking port, traveling at slightly more than 1 inch per second at contact.